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#3100

From: Angela Nance
To: cmccourt@altoncoal.com; ddragoo@swlaw.com
CC: Dana Dean; Daron Haddock; John Baza
Date: 7/2/2009 3:16 PM
Subject: Coal Hollow, AVF Memo
Attachments: CoalHollowAVFMemo.pdf

Attached please find the Technical Memorandum dated March 31, 2009 regarding the Alluvial Valley Floor Review for the Coal Hollow Mine.

TECHNICAL MEMORANDUM
Utah Coal Regulatory Program

March 31, 2009

TO: Internal File

THRU: Daron Haddock, Permit Supervisor

FROM: Priscilla Burton and Coal Hollow Review Team PBby,SDS

SUBJECT: Alluvial Valley Floor Review – Coal Hollow Mine, Alton Coal Development, LLC, Kane County, C/025/005, Task ID #3100,

SUMMARY:

The Coal Hollow Review team members (Jim Smith, Dave Darby, Joe Helfrich, Wayne Western and Priscilla Burton) have had several technical discussions on the potential for an Alluvial Valley Floor within the Coal Hollow permit area. What follows is a compilation of the views expressed by all team members during these discussions.

After evaluation of the application contents with regard to R645-302-321, the Division finds that Sink Valley below Kane County Road 136 is a typical AVF, with a well defined, continuous channel, floodplain, and terraces, although the agricultural use at this location has not been demonstrated. The Division finds that there are certain characteristics of an AVF in Section 29, T. 39 S, R. 5 W (agricultural activity, subirrigation and water availability), but not the defining geomorphology (floodplain and terraces) ordinarily found in an AVF. The unusual hydrologic importance of subirrigation to agricultural activity along the eastern boundary of the proposed permit area indicates to the Division the importance of maintaining and protecting the function of the near surface groundwater flow in this area. While not affirming the Division's finding in 1988 that there is an AVF in Sink Valley in Sections 19, 20, 29, and 30, there are characteristics indicating a possible AVF in Section 29 between the Tropic Shale Ridge (Dwg. 6-9) and Swapp Hollow, and possibly extending southward to include all of Sink Valley in Section 32.

The 2008 Coal Hollow mine plan is also under review for alluvial valley floor character by a third party. There has been no final AVF determination made at this time.

The applicable R645-302 rules are used to organize the discussion below. The review team members have had an opportunity to review, comment and edit this assessment, prior to its inclusion in the Technical Analysis on March 30, 2009.

ALLUVIAL VALLEY FLOORS

Regulatory Reference: 30 CFR 785.19; 30 CFR 822; R645-302-320.

Analysis:

Alluvial Valley Floor Determination

The applicant has made a request for determination of alluvial valley floor for the proposed Coal Hollow Mine and Sink Valley Wash area.

Background Information

The Alton/Sink Valley area was the subject of a much larger, mine permit application in 1982 and 1987 by Utah International Inc. (UII, P/025/003). The UII application included the Sink Valley area in T 39 S, R. 5 W. and surrounding federal leases in T. 39 S., R. 6 W.; T. 40 S., R. 4 W.; T. 40 S., R. 4 ½ W; T. 40 S., R. 5 W; and T. 40 S., R. 6 W. The federal leasing required an Environmental Impact Statement (Development of Coal Resources in Southern Utah, 1979). The Office of Surface Mining (OSM) commissioned a reconnaissance report of the alluvial valley characteristics of the Alton Area in 1980. The resulting report, by Jack Schmidt was titled, "Reconnaissance Determination of Alluvial Valley Floor Status and Assessment of Selected Geomorphic Parameters in selected Stream Valleys of the Alton Petition Area and Adjoining Lands, Garfield and Kane Counties, Utah." The Schmidt report details agricultural production, water rights and water diversions in the Alton amphitheater and Johnson Canyon at the time. The report describes a very active agricultural community in Sink Valley and adjacent areas. (Jack Schmidt's full 1980 report can be found at 025/0005/2006/Incoming/0012.pdf.)

In 1983, OSM mapped the Sink Valley alluvial valley floor (AVF) and stressed the importance of agricultural land use in making the Sink Valley AVF determination, in the absence of more typical geology associated with an alluvial valley (OSM 1983 [draft] Alluvial Valley Floor Identification and Study Guidelines, Appendix D, pg. D-2 and D-6). OSM stated that the initial reconnaissance conducted of the Alton area by Jack Schmidt in 1980 was sufficient to confirm the existence of an alluvial valley floor based upon the importance of the valley land to agriculture (pg. D-4), but suggested that an Applicant for a mine permit might collect additional data to clarify the regional hydrologic pattern (page D-2).

OSM was required to make specific detailed findings with regard to the protection of the hydrologic balance and reclamation during the processing of the Alton mine permit application (which included tracts of federal leases) in response to petition and litigation in United States District Court for the District of Utah, Central Division (0250003/1987/Incoming/0040.pdf). The Court's Memorandum of Decision and Order was dated February 12, 1985.

The February 8, 1988 Initial Completeness Review for the 1987 UII Alton Mine application indicates on page 34 that the following areas were identified as probable alluvial valley floors (filed as 0025/0003/1988/Incoming/0023.pdf):

1. Upper Skutumpah Creek, Sec. 20 and 29, T40 S., R 4 1/2 W.
2. Skutumpah Creek, Sec. 30, T. 40 S., R. 4 ½ W.
3. Thompson Creek and Tributaries, Sec. 30 and 19, T. 40 S, R 4 ½ W and Sec. 24, 13, 12, T 40 S., R. 5 W.
4. Bald Knoll Hollow, Sec. 14, 15 and 16, T. 40 S. R. 5 W.

The Division further stated in the Initial Completeness Review on pages 35 that the following areas had been "positively" determined to be Alluvial Valley Floors:

1. Skutumpah Creek in Sec. 32, T.40.S., R.4 ½ W. and Sec. 5 and 6 in T.41 S., R. 4 ½ W.
2. Thompson Creek in Sec. 31, T.40 S., R.41/2 W. and Section 6 in T.41 S., R.4 1/2 W.
3. Upper Sink Valley Wash in Sec. 32, T. 39 S., R. 5 W. and Sections 5 and 8 in T. 40 S. R. 5 W.
4. Sink Valley in Sections 19, 20, 29, and 30, T. 39 S., R. 5 W.
5. Lower Swapp Hollow in Sec. 28, T. 39 S., R. 5 W.
6. Kanab Creek in Section 18, 24, 25, 26, and 36, T. 39 S., R. 5 W.
7. Alton Amphitheater in Sec. 6 and 7, T.39S., R.5W. and Sec. 1, 11, 12, and 13 in T.39S. R.6W.

The Coal Hollow proposed permit area encompasses the Sink Valley in Section 19, 20, 29 and 30 in T. 39 S., R. 5 W. The Division's 1988 decision was based upon borehole data showing sorted deposits of sand size or larger particles and previously published information, as laid out in a memo from Richard Smith, Geologist, to John Whitehead, Permit Supervisor, dated November 9, 1987 (025/0003/1987/Internal/0002.pdf).

The UII commissioned Water Engineering Technology, Inc. (WET) of Fort Collins, CO to evaluate the Sink Valley area. The1988 WET report, titled "Geomorphological and Sedimentological Characteristics of Sink Valley, Kane County, Utah" argued that the sediment in Sink Valley is comprised of coarse material in an alluvial fan laid down by unconfined sheet floods, debris flows and mud flows. The report claims there was never a continuous stream in Sink Valley. Thus, by R645-100 definition, a lack of a continuous stream channel meant an alluvial valley floor in Sink Valley could not exist.

The Division was not persuaded by the WET report. To the contrary, Richard Smith, Division Geologist, viewed the WET report as further evidence of unconsolidated stream-laid deposits holding streams and reported as much to the Division Associate Director, Ken May, on October 13, 1988. His memo cited near surface deposits of sand

sized particles, selectively sorted, and deposited within and adjacent to stream channels, as well as the presence of smooth land surfaces and channels exceeding 3.0 ft. wide X 0.5 ft. deep within Sink Valley, and the established agricultural land use, for a positive determination of an alluvial valley floor in Sink Valley (0250003/1988/Internal/0001.pdf).

In December 1988, Nevada Electric Investment Company (NEICO, a partner in UII) petitioned the Board of Oil, Gas and Mining for review of the Division's AVF determination. At the present time, no record has been located of the outcome of that petition, and there is reason to believe the cause was never heard before the Board. NEICO's assertions that Sink Valley is not an AVF are, in brief, that Sink Valley does not contain a continuous stream, the unconsolidated alluvia do not have the characteristics of streamlaid deposits, and there is no floodplain – terrace complex because the processes need to form them did not and do not exist in Sink Valley: these are similar to the arguments made in the current application.

Current Coal Hollow Mine Application

The Division staff have reviewed the 2008 Coal Hollow Mine application for information pertaining to the existence of an Alluvial Valley Floor. The application is under review by a third party as well. There has been no final determination made at this time.

The 2008 Coal Hollow Mine application includes the WET 1988 investigation in Appendix 7-4; current reconnaissance by Peterson Hydrologic Inc. in Appendices 7-1; and. Alluvial Valley Floor Supplemental Information in Appendix 7-7 that specifically addressed land use, soils, vegetation and hydrologic questions raised by the Division during the 2007 Administrative Completeness review.

In the discussion below, the Division evaluates the application for information pertinent to R645-302-321, in order to make a determination of the extent of any alluvial valley floor within the proposed permit area, and adjacent area, per R645-302-321.300. The applicable R645 Rules are used to organize the discussion.

R645-302-321.210 Mapping of Unconsolidated Streamlaid Deposits Holding Streams

Appendices 7-1 and 7-4 refer to the definition of "alluvial valley floor" in the R645-100 Rules which exclude from an alluvial valley floor all "upland areas...composed chiefly of debris from sheet erosion, deposits formed by unconcentrated runoff ...or other mass movement accumulations..." The term, "upland areas" is also defined in R645-100 and means, "those geomorphic features located outside the floodplain and terrace complex, such as isolated higher terraces, alluvial fans...."

The applicant states that no flood plains or stream laid deposits were identified in the project area, consequently a map of the flood plain and terraces was not created for Robinson Creek and Sink Valley Wash (App. 7-7, pp. 4-5). The Applicant found no evidence of flood plain and terrace features that are characteristic of alluvial valley floors (App. 7-7, pp. 4-5) and suggests that coalesced alluvial fans form the surface of Sink Hollow Wash (App. 7-7, pp. 2-3). This position is strongly supported by the information presented in Appendix 7-4, the WET Report.

The Applicant suggests the lack of continuous channel is indicative of an alluvial fan, due to deposition by mud flows, sheet floods, and debris flow, but also that the lack of a continuous channel may be partly due to human activity (construction of diversions, ponds) . The Applicant refers to Plate 1 in App. 7-7 showing numerous discontinuous channels, but no continuous channel in Sink Valley Wash. The Division notes the discontinuous channels shown on Plate 1 seem to coincide with the historically developed pastureland shown on Dwg 3-1. If the ponds that have been constructed in the channel are taken into account, it is evident that Sink Valley Wash is a continuous channel from its origin in Section 21 Canyon and to the east of the Johnson Ranch; however, in the NW/4 of Section 32, the channel dissipates and the flow is spread across the surface as overland flow, which has been described by the Applicant.
[A deficiency has been written to request that the permit boundary should be shown on Plate 1 for ease of comparison with other (larger scale) plates.]

Neither the federal or R645 Rules use the term "continuous channel" to define alluvial valley floor. Drawing 7-3, indicates continuous point-to–point diversions along the length of the Sink Valley Wash channel and the USGS Alton Topographic Quad shows a continuous channel for Sink Valley Wash. Figure 19, App. 7-1, shows the tributaries to Sink Valley. The figure and several maps show a stream channel in Sink Valley. Sink Valley has the appearance of an alluvial valley floor, because it once contained a continuous stream channel, which deposited alluvial stream laden sediments. There are undoubtedly both coalluvial and stream laid deposits Sink Valley from past geomorphic activity. After reviewing the information in the PAP and the WET report the Division concludes it's likely that both alluvial and coalluvial systems operated to form large alluvial fans along the edge in Sink Valley. In the middle and below Swapp Hollow the streams running from the fan combine to form an alluvial channel down Sink Valley. The stream flows that enter the valley in the early spring is now captured and dispersed along the valley via ponds and diversions. Maps including Plate 2, shows the surface water drainage patterns, and Drawing 7-7 shows stream patterns. The aerial photograph of Plate 4 shows the surface features in Sink Valley, including the alluvial fan at the upper end of the valley. Most of the main channel has been covered in the past by farming activity, leaving a series of ponds that outline the channel. If the streamflow to the valley was significant the channel would most likely have been left intact. Some of the runoff from Water Canyon is diverted to Robinson Creek while the rest of the water including that from Section 21 Canyon infiltrates into the alluvial fan at the upper end of Sink Valley. It is believed that the finer alluvial that has built up in the middle of Sink Valley as it filled with sediment material retards the groundwater flow in the eastern and western sides of the valley.

On October 1 and 2, 2008, Division personnel examined the area for AVF characteristics. They determined that upper Sink Valley Wash, where the mine is proposed, consists of alluvial fan deposits, with no floodplain and terrace complex. There was no consensus as to whether or not there is a continuous channel, even when the impacts of human modifications are accounted for. Although some characteristics for an AVF are present (see definitions for both "Alluvial Valley Floor" and "Upland Areas" in R645-100-200, i.e., unconsolidated stream-laid deposits and agricultural activity supported by irrigation and subirrigation), not all characteristics listed in the definitions in the Coal Mining Rules are clearly present, i.e., stream-laid deposits holding streams with water availability sufficient for irrigation or subirrigation agricultural activities. There is water available for subirrigation and irrigation, but the "stream" through Sink Valley Wash is not the only source of the water. Subirrigation and agricultural activity also occurs on the edges of Sink Valley where groundwater flows through coalluvial deposits from the adjacent hillsides. By definition these conditions do not constitute an AVF. The Applicant plans to mine in the vicinity of the springs and groundwater resource flowing through the coalluvium. The Applicant has been directed to submit water rights data to identify any spring and well with state appropriated waters that may have to be replaced (see deficiency written under R645-301-720 in Environmental Resources/Hydrology).

The ground water supply from Robinson, Water, Section 21 Canons and Swapp Hollow recharge the springs in Sink Valley as well as the deep groundwater system and alluvial stream laid deposits. As mentioned the stream laid deposits are less porous and have less transmissivity than the coalluvial deposits. From the WET Report it is interpreted that the stream laid deposits range along the eastern to middle part of Sink Valley beginning below Swapp Hollow to the lower canyon of Sink Valley. The sedimentary structure of Sink Valley Wash consists of colluvium and alluvial fans deposited by unconcentrated runoff, and there is no floodplain and terrace complex.

In Appendix 7-4, the application describes the origins of Sink Valley through the burial of Tropic Shale by Wasatch sediments brought down from adjacent canyons (Robinson, Dry Creek, Sec. 21 Canyon and Swapp Hollow) and the eventual lowering of Robinson Creek, which siphoned off a portion of the Sink Valley flow, creating a residual alluvial fan bordered by a Tropic Shale ridge. The shale ridge blocks subsurface flow of groundwater to the west, bringing the shallow groundwater system to the surface on the eastern boundary of the permit area as evidenced by numerous seeps and springs shown on Dwg. 7-1 (pp.7-3 and 7-4 Sec. 721, Chap. 7). These seeps and springs either sub-irrigate the lands within, east, and south of the permit area or they fill ponds for domestic, stockwatering, irrigation, or wildlife uses (Table 1, App. 7-1 & App. 7-3). This area is generally represented by groundwater discharge area A on Dwg. 7-4.

The Applicant describes a preferential pathway for alluvial groundwater flow through deep coarse-grained alluvial sediments along the east side of Sink Valley, outside the proposed permit area (Chap. 7, Section 721, 728 p. 7-26). This deep water was tapped at artesian wells Y-102, Y-61, Y-59, and C5 (Fig. 13, App. 7-7). The deeper

groundwater system is in communication with wells SS at the south end of the permit area, where data from SS wells provides evidence of a 15 foot thick, highly permeable strata located 60 to 75 feet below the surface (Chap 7, Sec. 727, p. 7-27 and App. 7-1, Table 8). The application states that this coarse stratum is in contact with the artesian groundwater system found in Section 29, east of the proposed permit boundary, and that groundwater recharge to the lower half of the Sink Valley sediments occurs via horizontal migration. Artesian wells were also noted to the south of the permit area in Section 32 (Chap 7, Sec. 721, p. 7-5). This area is generally represented by groundwater discharge area B on Dwg. 7-4.

The depth of the water bearing coarse strata in well SS (App. 7-1, Table 8) corresponds with the top of the coal elevation shown on Dwg. 6-5 at the SS well location(not on drawing 6-5). Thus, the coal seam that is 200 feet below the surface at the mouth of Swapp Hollow (App. 7-1, Table 5, Well 36) may be in contact with the artesian water in surrounding wells that are screened at depths 62 to 142 feet below the surface (App. 7-1, Table 5). Alternatively, the Tropic Shale (which forms a barrier to water movement in the northern part of the permit area) thins to the south of the permit area and becomes less of an impedance to water flow between the alluvium and the coal to the south of the permit area. The application indicates that flow through the deep, coarse fragments provides better quality, water emanating from SP 32, south of the permit area (Chap. 7, Section 721, p. 7-8). The same strata would likely be responsible for the flows into Sink Valley at SP4 and SP 27 at the contact with the Dakota formation (just below the coal seam).

A small amount of flow (5 – 10 gpm) emanates in the channel at the coal seam as a spring to Robinson Creek in the northwest end of the permit area (Chap 7, Sec. 721, p. 7-6). While the coal seam is reported to have low transmissivity at Y-38 and Y-36 locations (Chap 7, Sec. 721, p. 7-4), the SS-75 well had high transmissivity (Table 7-8). Clearly the groundwater contained in this coarse stratum does not provide flow at SW 6 or SW 9 in the lower Sink Valley stream channel. These stream monitoring locations flow in response to snowmelt and precipitation events (Chap. 7, Table 4). Whether this groundwater 'daylights' downstream in lower Sink Valley should be determined.

The direction of shallow groundwater flow is shown in Figure 21 of App. 7-1. Dwg. 7-13 shows local saturation levels in the alluvium of Sink Valley, but does not represent a potentiometric surface. Alluvial ground water is present in confined piezometers at a depths of two to twenty feet within the proposed permit area (Table 1, App. 7-7). Unconfined water is evidenced by the numerous springs shown on Dwg. 7-1. The Applicant concluded that the distance between the monitoring wells and the perched, discontinuous nature of the saturated zones did not allow extrapolation of the potentiometric data for the entire permit area (App. 7-7, Sec. 2.6). The Applicant also concluded that an isopach map of the depth to saturation, based on the soils pits and shallow exploration bore holes, was not possible, because a continuous, saturated, ground-water system was not found (App. 7-7, pp. 7- 8). The Division notes that Table 2, App. 7-7 indicates depth to ground water in soil pits was between one and six feet on

the eastern side of the permit area and between four and ten feet in the center of the permit area.

Figure 8, App. 7-1 illustrates the geology in cross-section. Figure 8, App. 7-7 shows the streams, ponds, springs, and well locations in relation to surface geology, as well as the projected location of the pits and permit boundary. The Applicant states that Kanab Creek and its tributaries are downcutting. Robinson Creek, the only continuous channel in the Sink Valley Wash area, is deeply incised and appears to be actively downcutting. The Division notes that Appendix D of the 1983 OSM AVF Guidelines acknowledges the entrenched stream courses (pg D-4) and states that the central question becomes, what valleys have the capability to be irrigated?" (pg D-8). The OSM AVF assessment assumes water can be "transported to any terrace level, providing that a part of that level had historically been irrigated." (pg. D-8). The more important issue is water availability (pg D-9).

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The information provided indicates that there is not the typical terrace and stream channel geomorphology or a defined continuous channel in Sink Valley. The application describes a locally important artesian water source that is stratigraphically above the coal seam.

R645-302-321.220 Mapping of Agricultural Lands

The application describes shallow groundwater sources that provide subirrigation east of the Sink Valley Fault within the permit area, for agricultural activity on C. Burton Pugh's and Richard L. and Alicia S. Dame's meadowlands shown on Dwg. 3-1, and immediately east of the permit area for Darlynn and Arlene Sorensen's meadowlands and pasture shown on Dwg. 3-1. In addition, Sorensen's diversion structures are in place and irrigation can be implemented in high water years immediately east of the permit area. Pugh's irrigation diversion structures are in place, but in disrepair within the permit area. Dame's irrigation structures are not shown. Johnson's irrigation ditches are not shown.

App 7-7, Sec. 4.1 through 4.3 provides a description of the agricultural use of lands within and adjacent to the permit area by cattle and for crop production. The locations of existing undeveloped rangeland, subirrigated lands, crop lands and pastures are shown on Drawing 3-1 and Drawing 7-7. There are 69 acres of meadow, 192 acres of pasture, 215 acres of sagebrush/grass land and 40 acres of oak brush, and 114 acres of

pinyon /juniper in the permit area (un-numbered Table, Sec. 321.100, Chap. 3, pg. 3-3). Dry meadow acreage is described in Section 311.100, but the acreage was not calculated. The Division estimates the dry meadow acreage to be twenty acres. Meadow, pasture and oak brush are by far the most productive lands with production estimated (not measured) at between 1,100 to 2,000 lbs/acre (Table 3-34 ,Sec. 321.100, Chap. 3).

Grazing lands supported by numerous seeps and springs dominate the proposed permit area as shown in Chap 4, Ex. 4.1. Acreage used for pasture was not provided for Pugh or Dames lands, although one can estimate based upon the information in Section 321.100 described above that there is 261 acres of meadow and pasture. Production estimates for the meadow are 1 Ton/acre. The value of supreme to premium dairy quality alfalfa hay would be on the order of $130/Ton, based upon the Utah Department of Agriculture's February 27, 2009 (http://ag.utah.gov/news/publications/reports.html). Therefore, the value for the crop produced by 69 subirrigated meadow acres within the permit area would be $8,970 annually. The unirrigated pasture land within the permit area has half the productivity would have a crop value of $12,980 annually. Crop land east of the proposed permit area is illustrated on Ex. 4.1. Crop land is illustrated on Ex. 4.1 east of the proposed permit area. Acreage under production was not provided, and Ex. 4.1 has no scale, so that acreage cannot be calculated. Drawing 7-1 shows the total number of seeps and springs in the permit area available for grazing animals. Drawing 7-7 shows the ponds and ditches developed to support agriculture. Both Pugh and Dame own lands designated pastureland or subirrigated meadow lands within the permit area that have been leased to Alton Coal Development (Dwg. 3-1 and 7-7). These subirrigated lands are grazed to produce cattle, but are not cultivated to produce crops (Appendix 7-1, p. 48).

The number of cattle were not specified, although there may have been up to 750 in Pugh's herd at one time, based upon the water rights information provided in App. 7-3. Appendix 7-3 indicates that within and east of the permit area, within Sections 19, 20 and 30, Pugh holds three of eight water rights on stream reaches in Lower Robinson Creek with total allocations for 750 stock unit diversion limit. The BLM holds two additional water rights in Sec 19 and 20 that are allocated for stockwater for the Cecil Pugh grazing allotment No. 39, with a total of 26 stock unit diversion limit. Heatons have a water right just upstream of the BLM water right in Sec. 20, also for stock watering (1,600 stock unit diversion limit). Adjacent to the permit area, the BLM holds a water right in Sec 25 on Robinson Creek allocated for stockwater for Sharon Lamb grazing allotment No. 38, with a total of 18 stock units. The Lambs hold an additional water right in Sec 25 for stockwatering of 60 stock units.

Further upstream (east) from the permit area, Pugh and Sorensen also hold water rights on a reach of Right Hand Wash, in Sec 21, for 250 and 300 stock units, respectively.

Sorensen holds a water right on the stream in Sink Valley wash. Swapp and Lamb hold water rights on reaches of Kanab Creek for stockwatering, with a combined

460 stock diversion limit. The locations of these stream reach water rights are identified on Plate 7-3, Water Rights.

The Pugh lands were formerly quite productive: 700 bushels/acre of potatoes were raised with irrigation on the Pugh property in 1917 and in the 1950's oats and wheat crops were produced (personal communication with C. Burton Pugh, September 6, 2006).

East of the permit area, Darlynn Sorensen currently produces hay on 154 acres at the mouth of Swapp Hollow (Appendix 7-1, p. 48). Production from the Sorensen field varies by water year from 2,000 to 6,000 bales of hay (80 lbs each). This equates to 80 to 240 Tons of hay. The value of supreme to premium dairy quality alfalfa hay would be on the order of $130/Ton, based upon the Utah Department of Agriculture's February 27, 2009 (http://ag.utah.gov/news/publications/reports.html). At $130/Ton, the Sorensen's annual crop value would therefore be between $10,400 and $31,200.

The information provided indicates that subirrigated meadow currently supports limited agricultural activity within the permit area. Meadow and croplands east of the permit area supports a larger agricultural operation.

Acreage of crop production shown on Ex. 4.1 in the adjacent area should be provided as well as mapped, along with acreage figures and mapping of the adjacent areas under production along Kanab Creek and lower Sink valley.

R645-302-321.230 Mapping of Current or Historic Flood Irrigated Lands

The Division notes that Appendix D of the 1983 OSM AVF Guidelines acknowledges the topography does not fit the typical flood plain and terrace system, but that the topography is suitable for irrigation. The topography has a gentle slope of 1 – 5% in Soil Map Unit 7 and 3 – 8% in Map Units 1 and 4 (Section 222.300 and Dwg. 2-1). The Sorensen's hold three surface diversion rights in Right Hand Wash to irrigate 104.6 acres in the W ½ of Sections 29 and 32. Sorensens hold one water right for surface diversion on Swapp Canyon Creek and four water rights for surface diversions on Sink Valley Wash for irrigation of a combined 42.4 acres in the W ½ of Sections 29 and 32. In total the Sorensens hold water rights for the irrigation of approximately 143 acres in the W ½ of Sections 29 and 32 and stockwater for 300 units.

Johnson has one surface water right on Sink Valley Wash for the irrigation of 9.0 acres and stockwater for 125 stock units.

The application acknowledges the land is suitable for flood irrigation and that lands have been historically irrigated but that water availability limits the potential for irrigation (Chap. 7, Sec. 728, p. 7-3). Irrigation has not occurred within the proposed permit area for the last 10 years (p. 48, App. 7-1), but a defunct system of water distribution does exist for the Pugh property. The Dame property is subirrigated and apparently needs no supplemental irrigation. Table 2, App. 7-7 indicates depth to groundwater in soil pits was between one and six feet on the eastern side of the permit